

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 31 OCT 2005



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Applicant's or agent's file reference P10970PC	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/DK2004/000462	International filing date (day/month/year) 28.06.2004	Priority date (day/month/year) 27.06.2003	
International Patent Classification (IPC) or national classification and IPC C02F11/04			
Applicant BIO ENERGI APS I			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 10 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
  - a. ☒ sent to the applicant and to the International Bureau a total of 5 sheets, as follows:
    - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
  - ☒ Box No. I Basis of the opinion
  - ☐ Box No. II Priority
  - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - ☐ Box No. IV Lack of unity of invention
  - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - ☐ Box No. VI Certain documents cited
  - ☒ Box No. VII Certain defects in the international application
  - ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand 21.04.2005	Date of completion of this report 28.10.2005
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# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/DK2004/000462

## Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3 and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4)
    - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

### Description, Pages

1-11 as originally filed

### Claims, Numbers

1-42 filed with telefax on 17.10.2005

### Drawings, Sheets

1/4-4/4 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	
	No: Claims	1,22
Inventive step (IS)	Yes: Claims	
	No: Claims	2-21, 23-42
Industrial applicability (IA)	Yes: Claims	1-42
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

**Box No. VII Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**Box No. VIII Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

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**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. The amendments filed with the telefax dated 17.10.2005 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendments concerned are the following:  
The term "containers" and the expression "with containers for holding organic waste, the containers consisting of" found in claim 1 does not appear in the application as filed. The introduction of this terms broadens the scope of the claim because in the description the only devices disclosed for holding organic waste are the anaerobic tanks or reactors.  
The expression "consisting of" found in claim 22 does not appear in the application as file. This expression introduces unclarity because according to the figures and the embodiments of the description more steps are present in the process than those mentioned in claim 22.  
Therefore this report is established as if those amendments have not been made since they go beyond the disclosure in the international application as filed (Rule 70.2(c)).
2. Reference is made to the following documents:  
  
D1: WO 88/04282 A (WASTE ENERGY CORP) 16 June 1988 (1988-06-16)  
D2: EP-A-0 566 056 (RECYCLING ENERGIE ABFALL) 20 October 1993 (1993-10-20)  
D3: WO 03/097560 A (PRESECO OY ;JAERVENTIE JUSSI (FI)) 27 November 2003 (2003-11-27)  
D4: US-A-5 431 819 (HACK PETRUS J F M ET AL) 11 July 1995 (1995-07-11)
3. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1 and 22, as far as it can be understood, is not new in the sense of Article 33(2) PCT.
  - 3.1 Independent claim 1 refers to an entity (biogas producing facility) comprising two or three reactors or tanks which are suitable for carrying out anaerobic reactions. The output of the first reactor is connected (not necessarily a direct connection is needed, according to the description) to the input of another reactor named

"anaerobic tank" in the application. The output of this reactor can be connected to the first reactor or to a different reactor named "second reactor" in the application.

Document D2 discloses an installation (see Figure 1) comprising an anaerobic tank (3) in which biogas is produced, connected to (L22) an anaerobic tank (2) in which anaerobic hydrolysis is carried out, the latter (2) being connected (21) to the former (3).

The subject-matter of claim 1 is therefore not new with respect to D2.

- 3.2 Documents D1, D3 and D4 also discloses an anaerobic reactor to produce biogas, connected to an anaerobic tank in which a hydrolysis may take place and the further anaerobic digestion of the hydrolysed material in an anaerobic reactor. Therefore the subject-matter of claim 1, is not new with respect to D1, D3 or D4.
- 3.3 Document D3 discloses a method of producing biogas (see figure 2, 6, reference sign 90) comprising the steps of: digestion in a reactor (88), subsequent hydrolysis (62) and feeding the hydrolysed material (66) to the first reactor. Therefore the subject-matter of claim 22 is not novel with respect to D3.
- 3.4 Documents D1, D2 and D4 appear also to disclose an anaerobic step to produce biogas, connected to an anaerobic tank in which a hydrolysis may take place and the further anaerobic digestion of the hydrolysed material. Therefore the subject-matter of claim 22 is not new with respect to D1, D2 or D4.
4. Dependent claims do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to novelty and inventive step because those features have already been described in the cited documents or can presently only be regarded as merely defining options, possibilities or normal design procedures and thus would not comply with Article 33(1)(3) PCT in respect of novelty and/or inventive step.

#### **Re Item VII**

1. The features of the claims should be provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

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2. According to the requirements of Rule 11.13(m) PCT the same feature shall be denoted by the same reference sign throughout the application. This requirement is not met in view of the use of 12 in Figure 4 to designate the hydrolysis tank and 6 in Figures 1-3 to designate the same feature.
3. To comply with the requirements of Rule 5.1(a)(ii)PCT, the relevant background art disclosed in the documents D1, D2, D3 and D4 should have been mentioned in the description.

**Re Item VIII**

Dependent claim 2 and claims 3 to 21 when depending on claim 2 relate to a method or use, not an apparatus (Art. 6 PCT in combination with Rule 6.3(a)). Such claims should be drafted in terms of apparatus features.

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**CLAIMS**

1. A biogas producing facility with containers for holding organic waste, the containers consisting of  
5 a first reactor for holding organic waste for production of biogas by digestion and having an output for digested waste and an output for produced biogas, and  
an anaerobic tank with an input that is connected to the first reactor output for digested waste for anaerobic hydrolysis of the digested waste and having an output for hydrolysed material that is connected to an input selected from the group consisting of an input of the first reactor and an input of a second reactor for adding hydrolysed material to the content of the respective reactor.  
10
2. A biogas producing facility according to claim 1, wherein the anaerobic hydrolysis is performed at a pressure that is substantially equal to the saturation vapour pressure during a period of the anaerobic hydrolysis.
3. A facility according to claim 1 or 2, wherein the output for hydrolysed material is connected to an input of the first reactor.  
15
4. A facility according to claim 1 or 2, wherein the output for hydrolysed material is connected to an input of the second reactor.
5. A facility according to any of the preceding claims, further comprising a separator with an input that is connected to the first reactor output for digested waste for selective separation of particles larger than a predetermined threshold size from the digested waste and an output for the separated large particles that is connected to the input of the anaerobic tank.  
20
6. A facility according to claim 5, wherein the separation efficiency is enhanced by adding precipitation agents or polymers upstream the separator whereby the particle size upstream the separator is increased leading to improved retention of solids for downstream hydrolysis.  
25
7. A facility according to claim 5 or 6, wherein the threshold size is larger than or equal to a value selected from the group consisting of 0.1 cm, 0.2 cm, 0.5 cm, 1.0 cm, 1.5 cm, and 2.0 cm.
- 30 8. A facility according to any of claims 5-7, wherein the separator further comprises a dewatering device for dewatering of the separated particles.

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9. A facility according to any of the previous claims, wherein the anaerobic tank further comprises an input for reception of organic waste material in the tank for anaerobic hydrolysis together with digested material from the first reactor.
- 5 10. A facility according to any of the previous claims, wherein the hydrolysis is performed at a temperature range and for a time range selected from the group consisting of 50 °C – 75 °C for 0,25 to 24 hours, 70 °C – 100 °C for 0,25 to 16 hours, 100 °C – 125 °C for 0.25 to 8 hours, 125 °C – 150 °C for 0.25 to 6 hours, 150 °C – 175 °C for 0.25 to 4 hours, and 175 °C – 200 °C for 0.25 to 2 hours.
- 10 11. A facility according to any of the preceding claims, wherein the anaerobic tank is further connected to a pressure source for provision of a pressure in the anaerobic tank above 1 atmosphere.
12. A facility according to any of the preceding claims, further comprising a partitioning device for partitioning of organic waste and having an output for supplying the partitioned waste to the first reactor.
- 15 13. A facility according to any of the preceding claims, further comprising a tank for mixing a waste material with high dry matter content mixed with livestock dung and feeding the mixture into the first reactor.
14. A facility according to claim 13, wherein the waste material with high dry matter content comprises straw.
- 20 15. A facility according to any of the preceding claims, further comprising a tank for mixing a waste material with high dry matter content with hydrolysed material from the anaerobic tank and feeding the mixture to the first reactor.
16. A facility according to claim 15, wherein the waste material with high dry matter content comprises straw.
- 25 17. A facility according to any of claims 1-14, further comprising a tank for mixing a waste material with high dry matter content with hydrolysed material from the anaerobic tank and feeding the mixture to the second reactor.
- 30 18. A facility according to claim 17, further comprising a second separator that is connected to the second reactor output for selective separation of particles larger than a predetermined threshold size from the digested waste and having an output for the separated large particles, and wherein the anaerobic tank is connected to the second separator output for hydrolysis of the separated particles.



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19. A facility according to claim 18, wherein the second separator further comprises a second dewatering device for dewatering of the separated particles.
20. A facility according to any of claims 17-19, wherein the waste material comprises straw.
- 5 21. A facility according to any of the preceding claims, wherein the anaerobic tank has a gas output for supplying gas produced during hydrolysis to be combined with biogas output from the first reactor.
22. A method of producing biogas consisting of the steps of  
producing biogas by digestion of organic waste in a reactor,  
10 subsequently performing an anaerobic hydrolysis of digested waste in an anaerobic hydrolysis tank, and  
feeding the hydrolysed material to an input selected from the group consisting of an input of the first reactor and an input of a second reactor for adding hydrolysed  
15 material to the content of the respective reactor for further digestion and gas production.
23. A method according to claim 24, wherein the anaerobic hydrolysis is performed at a pressure that is substantially equal to the saturation vapour pressure during a period of the anaerobic hydrolysis.
24. A method according to claim 24 or 25, wherein the output for hydrolysed material is  
20 fed into the first reactor.
25. A method according to claim 24 or 25, wherein the output for hydrolysed material is fed into the second reactor.
26. A method according to claim 22, wherein the step of producing biogas further includes selective separation of particles larger than a predetermined threshold size  
25 from the digested waste and feeding the separated particles into the hydrolysis tank.
27. A method according to claim 28, wherein the separation efficiency is enhanced by adding precipitation agents or polymers upstream the separator whereby the particle size upstream the separator is increased leading to improved retention of solids for downstream hydrolysis.
- 30 28. A method according to claim 28 or 29, wherein the threshold size is larger than or equal to a value selected from the group consisting of 0.1 cm, 0.2 cm, 0.5 cm, 1.0 cm, 1.5 cm, and 2.0 cm.

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29. A method according to any of claims 28-30, wherein the separation includes dewatering of the separated particles.
30. A method according to any of claims 24-31, wherein the step of anaerobic hydrolysis includes inputting organic waste material into the tank for anaerobic hydrolysis together with digested material from the first reactor.
31. A method according to any of claims 24-32, wherein the hydrolysis is performed at a temperature range and for a time range selected from the group consisting of 50 °C – 75 °C for 0,25 to 24 hours, 70 °C – 100 °C for 0,25 to 16 hours, 100 °C – 125 °C for 0,25 to 8 hours, 125 °C – 150 °C for 0,25 to 6 hours, 150 °C – 175 °C for 0,25 to 4 hours, and 175 °C – 200 °C for 0,25 to 2 hours.
32. A method according to any of claims 24-33, wherein the anaerobic hydrolysis is performed at a pressure above 1 atmosphere.
33. A method according to any of claims 24-34, wherein the step of producing biogas by digestion of organic waste includes partitioning organic waste and supplying the partitioned waste to the first reactor.
34. A method according to any of claims 24-35, wherein the step of producing biogas by digestion of organic waste includes mixing waste material with high dry matter content mixed with livestock dung and feeding the mixture into the first reactor.
35. A method according to claim 36, wherein the waste material with high dry matter content comprises straw.
36. A method according to any of claims 24-37, wherein the step of producing biogas by digestion of organic waste includes mixing a waste material with high dry matter content with hydrolysed material from the anaerobic tank and feeding the mixture to the first reactor.
37. A method according to claim 38, wherein the waste material with high dry matter content comprises straw.
38. A method according to any of claims 24-37, wherein the step of feeding the hydrolysed material includes mixing a waste material with high dry matter content with hydrolysed material from the anaerobic tank and feeding the mixture to the second reactor.
39. A method according to claim 40, wherein the step of performing anaerobic hydrolysis includes selective separation of particles larger than a predetermined threshold size

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from the digested waste in the second reactor and feeding the separated particles into the hydrolysis tank.

40. A method according to claim 41, wherein the separation includes dewatering of the separated particles.
- 5 41. A method according to any of claims 40-42, wherein the waste material comprises straw.
42. A method according to any of claims 24-43, wherein the step of hydrolysis includes combining gas produced during hydrolysis with biogas output from the first reactor.